Supporting information

Morphology engineering of high performance binary oxide electrodes

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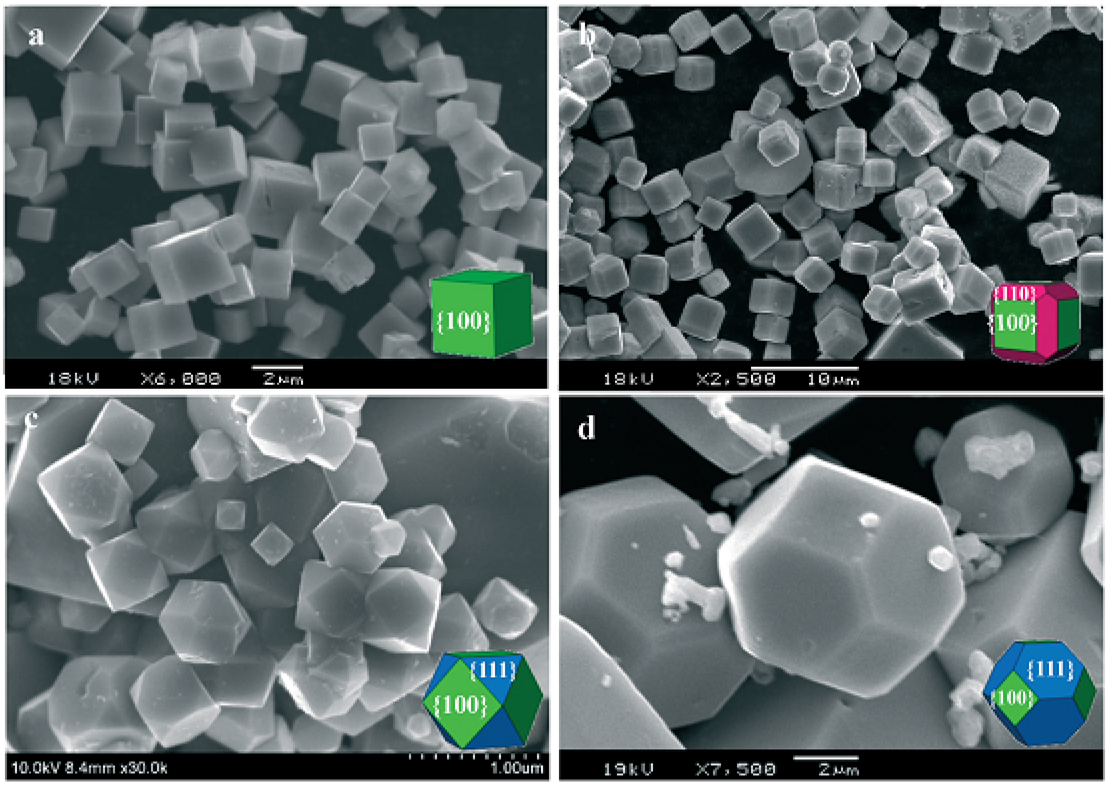


Fig. S1 SEM images of Cu_2O crystals, including (a) cube, (b) {110} truncated microcubes, (c) {111} truncated microcubes, (d) cuboctahedra.[27]

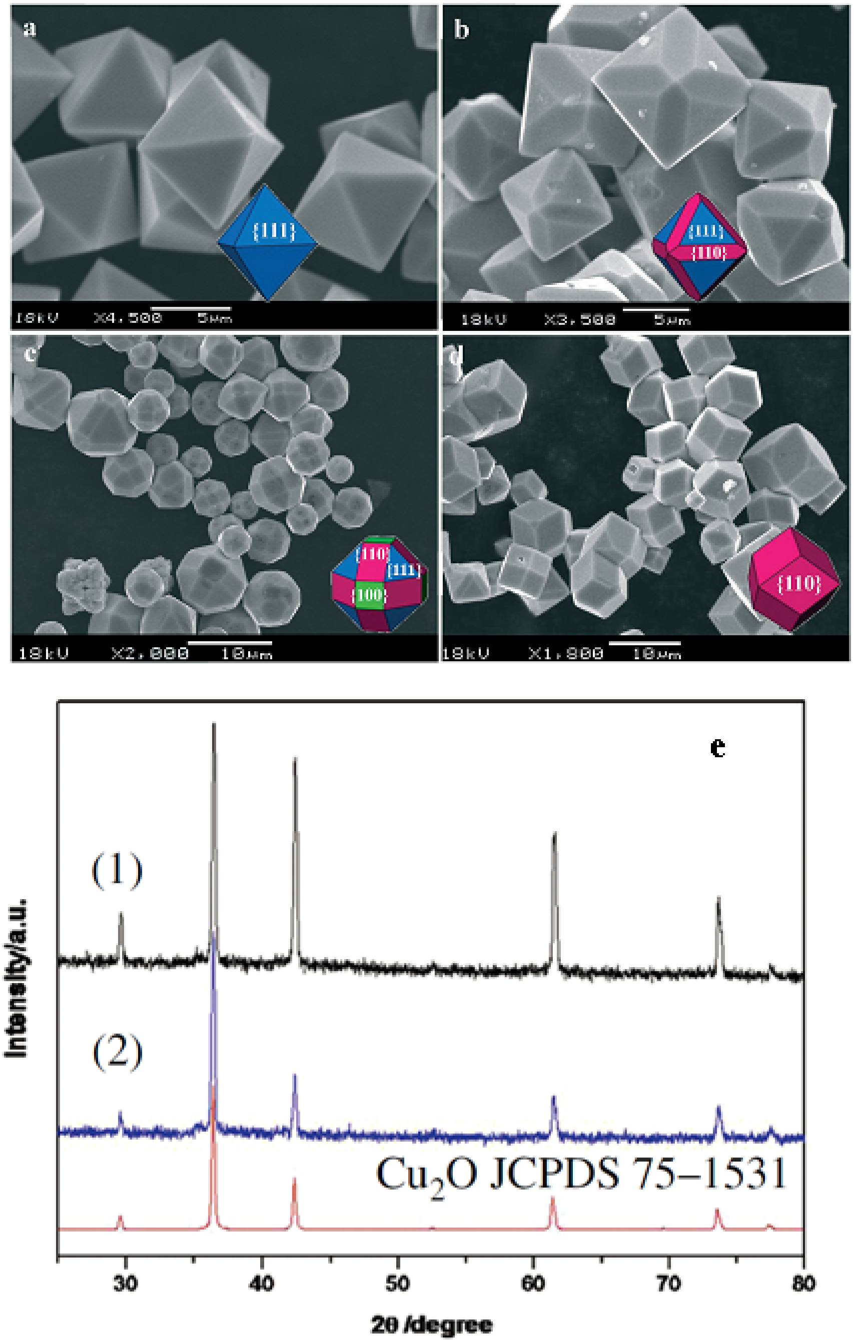


Fig. S2 SEM images of Cu_2O crystals. (a) Octahedra, (b) {110} truncated octahedra, (c) 26-facet polyhedra and (d) rhombic dodecahedra.[27] (e) XRD patterns of Cu_2O crystals.[33]

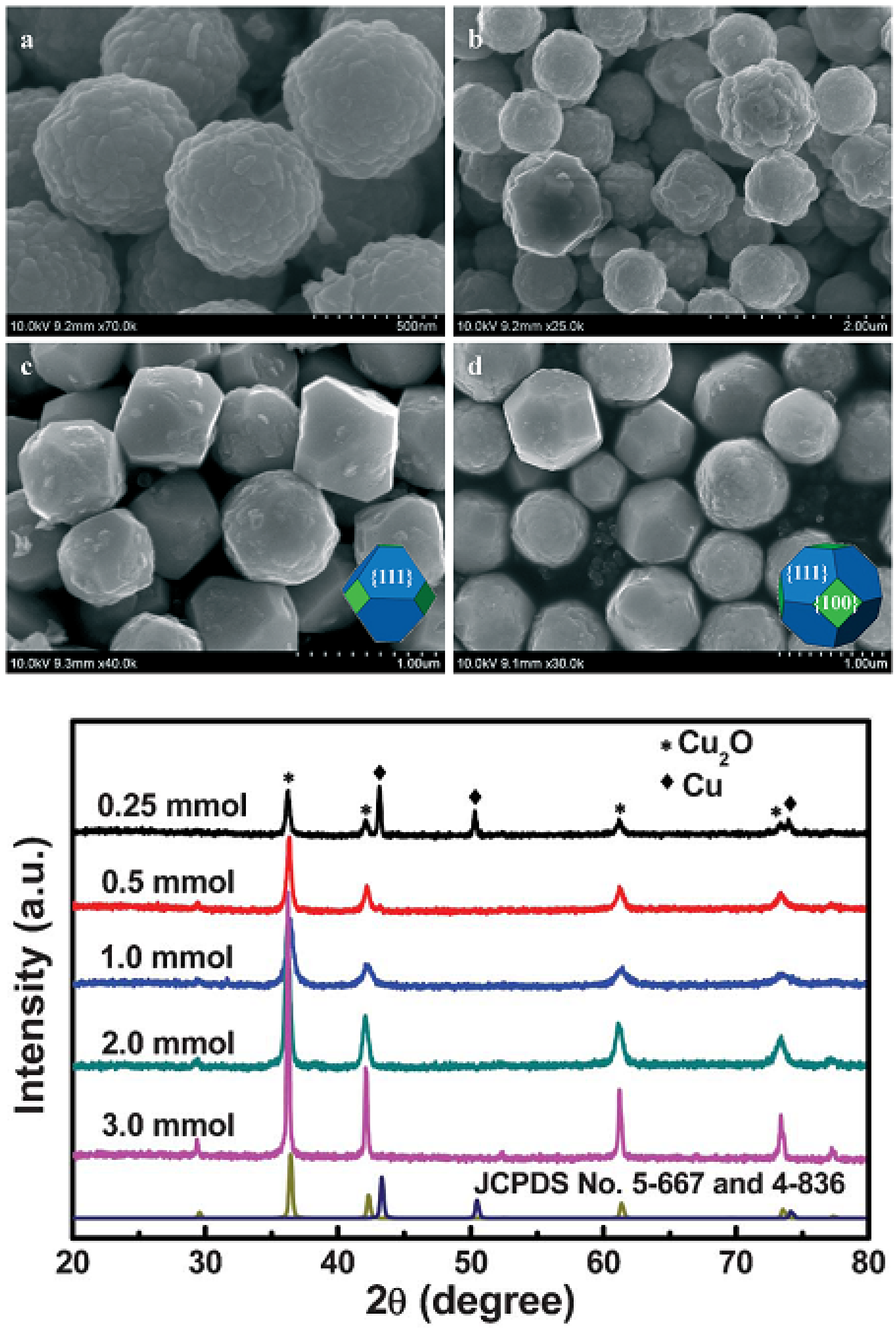


Fig. S3 SEM images of Cu_2O polymorphs. The nanoparticle-aggregated spheres (a), nanoparticle-aggregated octahedra (b), {100} truncated octahedra (c) and cuboctahedra (d). [27] XRD pattern of final products.[34]

Detail experimental information of EDTA-assisted hydrothermal method

Table S1 Reaction conditions of 64-kinds Cu_2O branching structures

EDTA/Cu Molar ratio	[Cu^{2+}]	pH	Temperature (°C)	Time (h)	Results
1	0.05	8	110	6	**Fig.** 5, Part I, a1,a2
1	0.05	8	110	12	**Fig.** 5, Part I, a3,a4
1	0.05	9	110	6	**Fig.** 5, Part I, b1,b2
1	0.05	9	110	12	**Fig.** 5, Part I, b3
1	0.05	9	110	24	**Fig.** 5, Part I, b4
1	0.05	9	120	6	**Fig.** 5, Part I, c1,c2
1	0.05	9	120	12	**Fig.** 5, Part I, c3
1	0.05	9	120	24	**Fig.** 5, Part I, c4
1	0.1	9	110	12	**Fig.** 5, Part I, d1−d4
1	0.1	9	120	24	**Fig.** 5, Part I, e1,e2
1	0.1	9	130	24	**Fig.** 5, Part I, e3,e4
1.5	0.05	8	110	12	**Fig.** 5, Part III, a1,a2, c1
1.5	0.05	8	110	24	**Fig.** 5, Part III, a3,a4
1.5	0.05	9	110	12	**Fig.** 5, Part III, b1,b2
1.5	0.05	9	110	24	**Fig.** 5, Part III, b3,b4
1.5	0.10	10	110	24	**Fig.** 5, Part III, c2−c4
1.5	0.10	11	110	12	**Fig**. 5, Part III, d1,d2
1.5	0.10	11	110	24	**Fig**. 5, Part III, d3,d4
1.5	0.10	12	110	12	**Fig.** 5, Part III, e1,e2
1.5	0.10	12	110	24	**Fig.** 5, Part III, e3,e4
1.5	0.10	13	120	12	**Fig.** 5, Part III, f1,f2
1.5	0.10	13	120	24	**Fig.** 5, Part III, f3,f4
2	0.05	9	100	12	**Fig.** 5, Part II, a1,a2
2	0.05	10	100	12	**Fig.** 5, Part II, a3,a4
2	0.05	11	110	12	**Fig.** 5, Part II, b1−b3
2	0.05	11	110	24	**Fig.** 5, Part II, b4
2	0.10	12	110	12	**Fig.** 5, Part II, c1,c2
2	0.10	12	110	24	**Fig.** 5, Part II, c3,c4
2	0.10	13	120	12	**Fig.** 5, Part II, d1,d2
2	0.10	13	120	24	**Fig.** 5, Part II, d3,d4
2	0.10	14	130	12	**Fig.** 5, Part II, e1,e2
2	0.10	14	130	24	**Fig.** 5, Part II, e3,e4

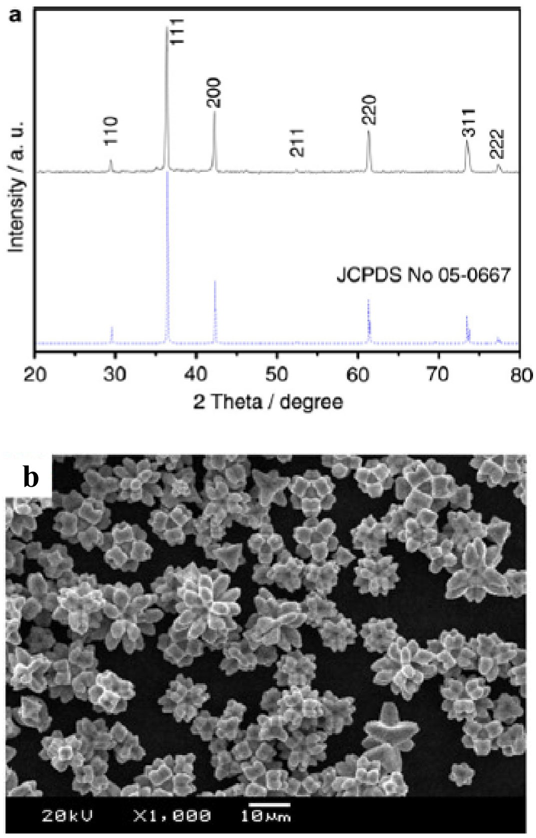
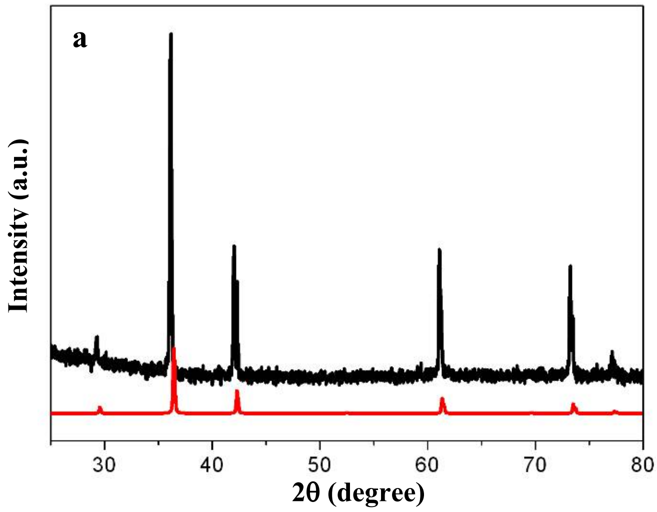


Fig. S4 XRD pattern of Cu_2O branching structure, showing the synthesis of phase-pure Cu_2O crystals.



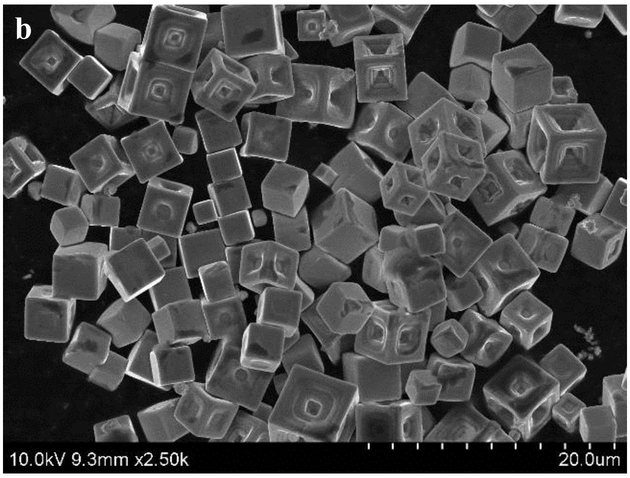


Fig. S5 (a) XRD pattern of Cu_2O hopper cubes, showing the synthesis of phase-pure Cu_2O crystals. (b) SEM images of Cu_2O hopper cubes.

CuO/Cu_2O lithium ion batteries

For lithium ion battery, working electrodes were prepared by mixing CuO/Cu_2O sample, acetylene black, and poly(vinylidene fluoride) (PVDF) in a weight ratio of 70:20:10. The mixtures were blended with N-methyl-2-pyrrolidone and pasted onto the copper foils. A galvanostatic cycling test of the assembled half cells was conducted on a LAND CT2001A system at a discharge−charge rate of 100 mA g−1 and in the voltage range of 0.01−3.0 V (vs Li^+/Li). Cyclic voltammetry (CV) measurements were carried out by an electrochemical workstation (CHI 660D) at the scan rate of 0.1 mV/s and with the potential window of 0.01−3 V.

CuO/Cu_2O supercapacitors

For the supercapacitor properties, working electrodes were prepared by mixing Cu2O, acetylene black, and polytetrafluoroethylene (PTFE) in a weight ratio of 80 : 10 : 10. Briefly, the resulting paste was pressed onto a sheet of nickel foam at 10 MPa. A classical three-electrode configuration was used in a 2 M KOH electrolyte. A saturated calomel electrode (SCE) was used as the reference electrode, and a Pt wire as a counter electrode. The cyclic voltammetry (CV), and galvanostatic charge–discharge measurements were carried out by an electrochemical workstation (CHI 660D).

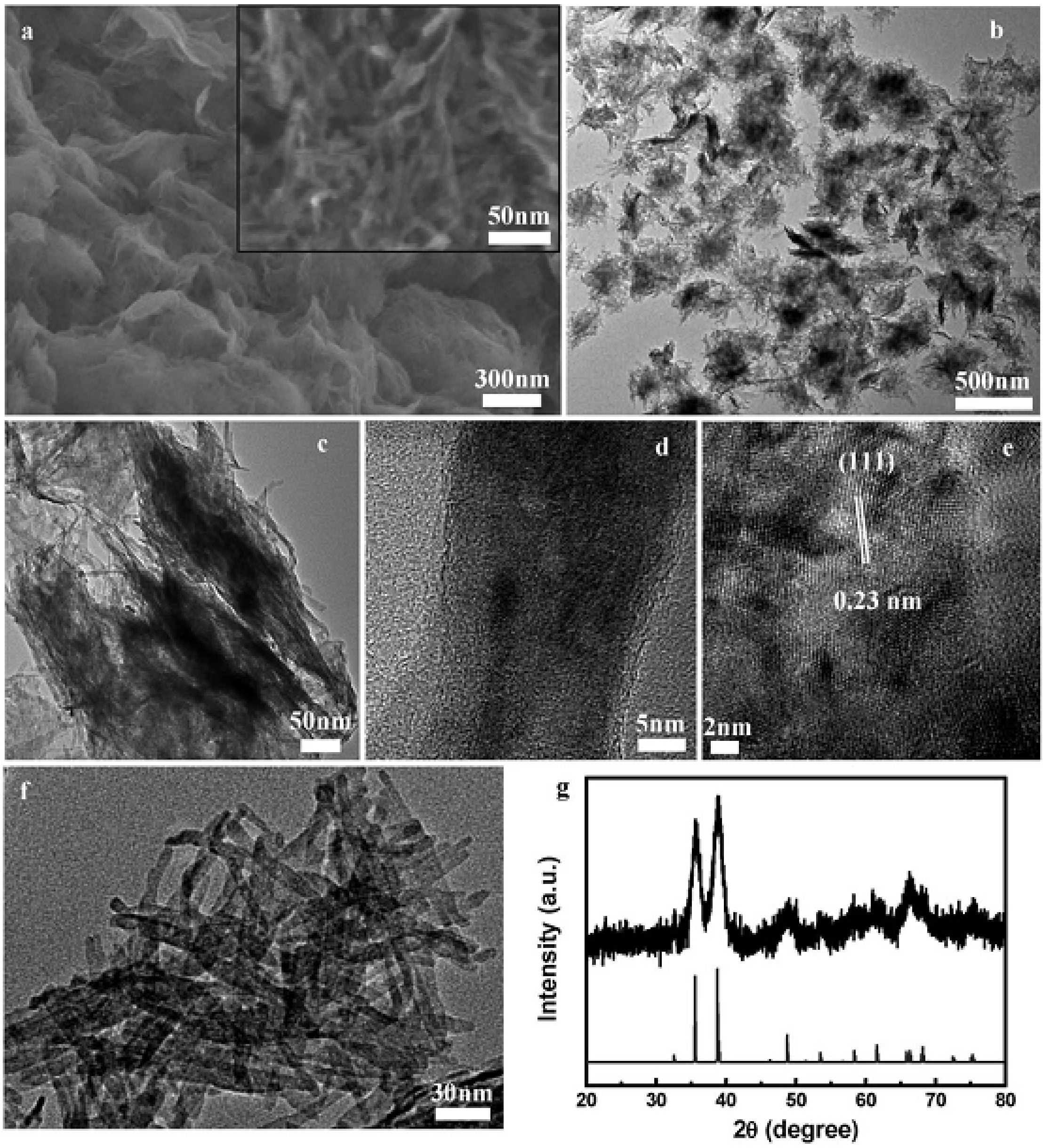


Fig. S6 SEM (a), TEM (b, c and f), and HRTEM (d and e) images of the as-obtained CuO nanoribbons with adding 5 mmol NaOH. Inset in (a) is the magnifying SEM image. XRD pattern (g) showing the products are CuO with standard JCPDS No. 72-629.[74]